

From the INTERNATIONAL BUREAU

**PCT**NOTIFICATION CONCERNING  
TRANSMITTAL OF COPY OF INTERNATIONAL  
PRELIMINARY REPORT ON PATENTABILITY  
(CHAPTER I OF THE PATENT COOPERATION  
TREATY)

(PCT Rule 44bis.1(c))

To:

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P.O. Box 387  
Bedford, Massachusetts 01730  
ETATS-UNIS D'AMERIQUE

Date of mailing ( <i>day/month/year</i> ) 05 November 2009 (05.11.2009)		
Applicant's or agent's file reference <u>ZON-016CPPC</u>		<b>IMPORTANT NOTICE</b>
International application No. PCT/US2008/004644	International filing date ( <i>day/month/year</i> ) 10 April 2008 (10.04.2008)	Priority date ( <i>day/month/year</i> ) 22 April 2007 (22.04.2007)
Applicant ZOND, INC. et al		

The International Bureau transmits herewith a copy of the international preliminary report on patentability (Chapter I of the Patent Cooperation Treaty)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. +41 22 338 82 70	Authorized officer  Athina Nickitas-Etienne  e-mail: pt04.pct@wipo.int
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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference ZON-016CPPC	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. PCT/US2008/004644	International filing date ( <i>day/month/year</i> ) 10 April 2008 (10.04.2008)	Priority date ( <i>day/month/year</i> ) 22 April 2007 (22.04.2007)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant ZOND, INC.			

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- |                                     |              |   |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I    | Basis of the report   |
| <input type="checkbox"/>            | Box No. II   | Priority  |
| <input type="checkbox"/>            | Box No. III  | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |
| <input type="checkbox"/>            | Box No. IV   | Lack of unity of invention  |
| <input checked="" type="checkbox"/> | Box No. V    | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/>            | Box No. VI   | Certain documents cited   |
| <input type="checkbox"/>            | Box No. VII  | Certain defects in the international application  |
| <input checked="" type="checkbox"/> | Box No. VIII | Certain observations on the international application   |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. +41 22 338 82 70	Date of issuance of this report 27 October 2009 (27.10.2009)
	Authorized officer  <b>Athina Nickitas-Etienne</b>  e-mail: pt04.pct@wipo.int

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

## PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY  
(PCT Rule 43bis.1)

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference  
see form PCT/ISA/220

**FOR FURTHER ACTION**  
See paragraph 2 below

International application No.  
PCT/US2008/004644

International filing date (day/month/year)  
10.04.2008

Priority date (day/month/year)  
22.04.2007

International Patent Classification (IPC) or both national classification and IPC  
INV. H01J37/32

Applicant  
ZOND, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII: Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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NL-2280 HV Rijswijk - Pays Bas  
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl  
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Date of completion of  
this opinion

see form  
PCT/ISA/210

Authorized Officer

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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/US2008/004644

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**Box No. I Basis of the opinion**

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1. With regard to the **language**, this opinion has been established on the basis of:
  - ☒ the international application in the language in which it was filed
  - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material:
    - ☐ on paper
    - ☐ in electronic form
  - c. time of filing/furnishing:
    - ☐ contained in the international application as filed.
    - ☐ filed together with the international application in electronic form.
    - ☐ furnished subsequently to this Authority for the purposes of search.
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE  
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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	<u>1-27</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>6,19-27</u>
	No: Claims	<u>1-5,7-18</u>
Industrial applicability (IA)	Yes: Claims	<u>1-27</u>
	No: Claims	

**2. Citations and explanations**

see separate sheet

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V.

1 Reference is made to the following documents:

D1 : US 2005/184669 A1 (CHISTYAKOV ROMAN [US]) 25 August 2005 (2005-08-25)  
cited in the application

D2 : US 6 327 163 B1 (PETR RODNEY [US]) 4 December 2001 (2001-12-04)

D3: JP 2004 010979 A (SDC KK) 15 January 2004 (2004-01-15).

2 INDEPENDENT CLAIM 1

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

2.1.1 Document D1, which is considered to represent the most relevant state of the art to the subject matter of claim 1, discloses (the references in parentheses applying to this document):

*A plasma generator (fig. 1) comprising:*

*a a chamber (104) for confining a feed gas (108);*

*b an anode (124) that is positioned inside the chamber;*

*c a cathode assembly (116) that is positioned adjacent to the anode (124) inside the chamber; and*

*d a pulsed power supply (102) having an output (120, 125) that is electrically connected between the anode and the cathode assembly (par. 20),*

*the pulsed power supply comprising solid state switches (558; fig. 10; par. 134) [...]*

The following features of claim 1 relate to a method of using the plasma generator and do not limit the scope of claim 1. See also Item VIII, sec. 1.

*... so that the power supply (102) generates a multi-step voltage waveform (252,*

fig. 4) at the output having a low-power stage (258, fig. 4) including a peak voltage and a rise time that is sufficient to generate a plasma from the feed gas (par. 48) and a transient stage (278) including a peak voltage and a rise time that is sufficient to generate a more strongly-ionized plasma (par. 54).

2.1.2 The subject-matter of independent claim 1 differs from the disclosure of D1 in that the solid state switches are adapted to generate **micropulses**.

The further specification of the difference that at least one of a pulse width and a duty cycle of the voltage micropulses being varied relates to a method of using the solid state switches and does not limit the scope of apparatus claim 1 (see Item VIII, sec. 1).

2.1.3 The problem to be solved by the present invention may therefore be regarded as improved voltage generation by providing shorter pulses.

2.1.4 In view of D2 the solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

D2 relates to the same technical field as D1, namely power supplies for plasma generation, cf. D2: col. 1, l. 4-8.

D2 discloses (see col. 4, l. 12-18; col. 7, l. 9-11) this difference:

Solid state switches (thyristor switch) adapted to generate micropulses.

D2 also discloses this difference as the solution to the above-mentioned problem, cf. D2; col. 4, l. 15-17.

2.1.5 Therefore the features disclosed in D1 and D2 would be combined by the skilled person, without exercise of any inventive skills in order to solve the problem posed. The proposed solution in independent claim 1 thus cannot be considered inventive (Article 33(3) PCT).

3 DEPENDENT CLAIMS 2-5, 7-18

Dependent claims 2-5, 7-18 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(3) PCT). The reasons are as follows:

**Claims 2-4, 12-18:** Subject-matter of claims only relates to a method of using the plasma generator. Scope of claims not limited (see Item VIII, sec. 1).

**Claim 5:** D1 teaches an arc control circuit (par. 28).

**Claims 7, 8:** D2 teaches pulse width and peak voltage in the claimed range (col. 3, l. 16-17; col. 4, l. 16-17; col. 7, l. 6).

**Claims 9-11:** D3 teaches a micropulsed power source with computer-controlled voltage, current and pulse width (abstract).

4 DEPENDENT CLAIM 6

The combination of the features of dependent claim 6 is neither known from, nor rendered obvious by, the available prior art.

5 INDEPENDENT CLAIM 19

5.1 Document D1, which is considered to represent the most relevant state of the art, discloses (the references in parentheses applying to this document):

*A method of generating a plasma (claim 21), the method comprising:*

*a supplying feed gas proximate to an anode and a cathode assembly (claim 21, part a), par. 18);*

*b generating a first voltage [...] in order to generate a first voltage waveform of a multi-step voltage waveform that is applied to the anode and to the cathode assembly, the first voltage waveform having a peak voltage and a rise time that is sufficient to generate a plasma from the feed gas (claim 21, part b); par. 48; stage 258, fig. 4); and*



*c generating a second voltage [...] in order to generate a second voltage waveform of a multi-step voltage waveform that is applied to the anode and to the cathode assembly, the second voltage waveform having a peak voltage and a rise time that is sufficient to generate a more strongly-ionized plasma (claim 21, part c); par.54; stage 278, fig. 4).*

From this, the subject-matter of independent claim 19 differs in that:

The first and second voltages generated from first and second pulse trains comprising **micropulses** having a **first pulse width** and a **first duty cycle** and a **second pulse width** and a **second duty cycle**.

5.1.1 The subject-matter of claim 19 is therefore novel (Article 33(2) PCT)  
The problem to be solved by the present invention may be regarded as improved voltage waveform generation.

5.1.2 The solution to this problem proposed in claim 19 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

None of the available prior art addresses the problem of generating a multi-step voltage waveform by different sets of micropulses. D1 discloses a multi-stage voltage pulse which consists of a single voltage pulse having multiple stages. D2 discloses a power supply for generating micropulses. It is not disclosed if these so generated micropulses are used to generate a multi-step voltage waveform.

5.1.3 Claims 20-27 are dependent on claim 19 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

#### Re Item VIII.

1 As explained under the respective sections under Item V, some of the features in the

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING  
AUTHORITY (SEPARATE SHEET)**

International application No.

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apparatus claims 1-4, 12-18 relate to a method of using the apparatus rather than clearly defining the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT.

- 2 Claims 22, 26, 27 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claims attempt to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.